# Pathways to poverty alleviation through agricultural research

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# Introduction

## SPIA and Poverty Impacts

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# SPIA and Poverty Impacts

2010

- SPIA starts an initiative to stimulate poverty impacts studies
- Commission Alain de Janvry (UC Berkeley) to write methods-oriented review
- De Janvry highlights significant methodological deficiencies with previously published studies and advocates greater use of Randomized Control Trials (RCTs)
- Workshop at IFPRI with 7 CGIAR centers, 6 universities and 3 donors to solicit ideas for technologies that could be amenable to rigorous analysis of poverty impacts

# SPIA and Poverty Impacts

2011

- SPIA launches call for proposals to the CGIAR centers for impact studies focusing on poverty impacts
- Partnerships with universities preferred
- SPIA funds studies on:

  **Maize in Zambia / Malawi**

  CIMMYT + Michigan State + NMBU

  **Integrated agriculture-aquaculture in Bangladesh**

  WorldFish + Oregon State

  **Rice improvements since 1990s in SE Asia**

  IRRI + U Missouri / Iowa State

  **Integrative country study across CGIAR centers in Ethiopia**

  IFPRI with input from all CGIAR centers working in Ethiopia

# SPIA and Poverty Impacts

## 2012/13

- 3 country studies under DIIVA project

## 2014 Minneapolis workshop

- 60 participants,
- 5 sessions on different methodological approaches (each with study examples + critical discussion of methods)

# SPIA and Poverty Impacts

## Take Home Messages

- Very difficult to find strong evidence with a single study that covers the long causal chain from a new technology to long-run poverty impacts.
- Magnitude of impacts may be small in general; example: Virginia Tech studies on beans in Rwanda and Uganda estimate that reductions in poverty are on the order of 0.1% to 0.3%.
- Despite the challenges, producing this evidence should be a priority for the CGIAR

# Conceptual framework

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# Conceptual framework

- Poverty is a complex outcome!
- Pathways to poverty reduction do not necessarily involve agricultural research
- Many other factors drive poverty reduction
  - widespread economic growth and employment opportunities for low-skilled workers
  - safety net programs
  - social mobility for the poor
  - health and education
- Policy interventions are many: include those in housing, water and sanitation, infrastructure, etc.

# Conceptual framework

Widely held view is that there is a single important pathway to impact of a new agricultural technology

- Higher agricultural productivity
  - → relatively cheaper and more abundant food
  - → positive impacts on poor population groups
- A plausible pathway at the global level and over a long time period.
- But higher productivity neither necessary nor sufficient for poverty reduction
- At the local level and in the short run, it is entirely possible for a productivity-enhancing innovation to be **bad** for the poor; e.g. a labor-displacing innovation in an exportable crop.

→ Specific poverty impacts of a new technology depend on a complex set of circumstances: no easy generalization possible

# Conceptual framework

Instead, we need to think much more broadly about a wider range of potential impact channels:

- Productivity increases
  - Average productivity
  - Risk reduction/ resilience
- Improved quality of the resource base
- Healthier output (e.g. biofortification, lower exposures to agricultural chemicals and toxics)
- Reduced time burdens of production and processing
- Improved policies and institutions

# Conceptual framework

## Impact on different population groups

- Consumers
- Producers
- Agricultural workers
- Non-Agricultural workers
- Land owners

# Conceptual framework

## Impact on different population groups

- Consumers
  - Direct: Price-quantity effects
  - Indirect: reduction in processing and cooking time; reductions in time lost to poor nutrition and health; increases in labour available for market
- Producers
- Agricultural workers
- Non-Agricultural workers
- Land owners

# Conceptual framework

## Impact on different population groups

- Consumers
- Producers
  - Direct: Price effects and physical quantity effects
  - Indirect: changes in occupational exposures to toxics; increases in time available for other uses
- Agricultural workers
- Non-Agricultural workers
- Land owners

# Conceptual framework

Impact on different population groups

- Consumers
- Producers
- Agricultural workers
  - Direct: Wage effects
  - Indirect: migration, health risks (acute or chronic); changes in bargaining power
- Non-Agricultural workers
- Land owners

# Conceptual framework

## Impact on different population groups

- Consumers
- Producers
- Agricultural workers
- Non-Agricultural workers
  - Indirect: wage effects from changes in labour supply/demand
- Land owners

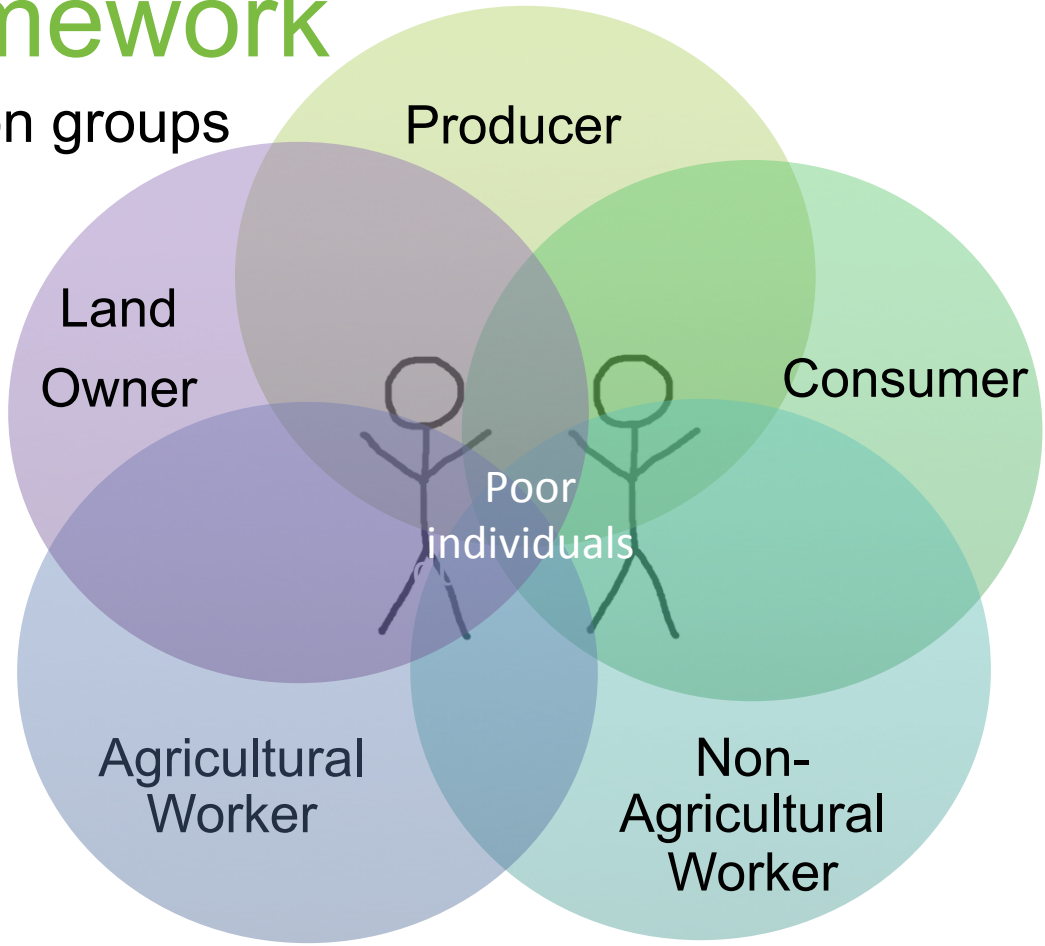
# Conceptual framework

Impact on different population groups

- Consumers
- Producers
- Agricultural workers
- Non-Agricultural workers
- Land owners
  - Changes in returns to land
  - Effects on land ownership distributions; patterns of ownership and control (e.g., gender)

# Conceptual framework

Impact on different population groups




- Overlap!
- Impacts are heterogenous **across** and **within** groups! e.g. gender, access to resources, political influence, capabilities;

# Methods and Literature

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# The “Impact Evaluation Problem”

Program evaluation cannot generally be treated as though it is an experiment.

- Program participation is not typically random, unless experimental methods are used.
- People not passive experimental subjects: make choices in response to programs being implemented

→ “true” program effect is difficult to identify: cannot simply compare participants and non-participants

→ likely to systematically differ in their characteristics, if these are correlated with outcomes: participation/ treatment is endogenous

- can control for characteristics that are observable but not for those that are “unobservable” (i.e. very difficult/ costly to measure, such as farmers' motivation and managerial skills, quality of land, etc.)

# The "Impact Evaluation Problem"

Challenges evaluating the impact of agricultural research on poverty

- Selection bias (on observable and unobservable characteristics)
- Heterogeneity of impact
- Placement bias of programs
- Diversification of income sources of households
- Intra-household impacts
- Dynamics: impacts likely to change over time

# Literature Review

The impact of agricultural research on household welfare/poverty

→ Focus on quantitative studies published during the last decade

**Type of studies**

- 36 micro studies investigating direct farm-level impacts of adoption of a single technology (21 cross-sectional, 7 panel, 10 experimental)
- 5 micro- and meso-studies on direct and indirect impacts of adoption of a single technology
- 15 macro studies on the impact of general agricultural productivity growth on poverty (4 model based, 11 econometric)

**Countries investigated**

- Mainly SSA, sometimes Asia (India and China)

# Toolkit to examine poverty impacts

| | |
|---|---|
| Micro econometric studies on direct farm-level impacts | • Observational cross-sectional (IV, PSM)<br>• Observational panel<br>• Quasi-experimental and experimental |
| Model based studies | • Agricultural household models<br>• Economic surplus analysis<br>• LEWIE models |
| Macro studies | • Poverty elasticities<br>• CGE models (single and multi-country) |

# Research Design

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# Research Design- Ingredients

- geographic area and time horizon of technology diffusion and impact
- key impact pathways and population(s) that will experience most significant impact
- appropriate counterfactual scenario
- defined and validated metrics to monitor uptake and impacts
- means of assessing attribution for the innovation

intrinsically forward-looking, often over a period of a decade or more

# Research Design- Sampling

## Geographic area

- Most representative ≠ highest adoption rates
- …or particularly interesting impacts.
- "sentinel sites"
  - many different commodities (agro-ecologically atypical?)
  - relatively high connectivity and good infrastructure ("economically" atypical?)

## Time horizon

- Time technology diffuses and impacts unfold?
- Risk of setting up baseline for technologies that are never extensively adopted at all or not adopted in that area

# Research Design- Counterfactuals

- Full randomization often not feasible; agricultural technologies diffuse freely and “control” is likely to be contaminated by “treatment.” The “treated” may not comply.
- Randomized experiments often possible only on small spatial scales and short time horizons; poverty impacts take place over long time horizons and wide spatial scales.
- Alternatives
  - Controlling for observables (PSM) and trying to measure unobservables as well as possible
  - Instrumental Variables approaches (identifying useful exogenous variation)
  - Household fixed effects (requires panel data and time variation in adoption)

# Research Design- Data collection

- Need appropriate outcome measures from the outset (baseline data!)
- Complexity of poverty impacts:
  - yields/ crop production measures insufficient,
  - changes in farmer decision making and reallocation of resources: net effect ≠ gross effect
  - may have to monitor entire farm-household portfolio of economic activities/ range of farm and household outcomes: (cost?)
- Time dimension of poverty impacts:
  - likely to be a long-run impact: requires sustained attention (cost?)
- Poverty impacts are likely to be small in magnitude in many cases.
  - Sample size and power calculations (cost?)

# Research design

## Observational cross-sectional studies

**More suitable**

- feasible even if adoption widespread (but not complete)
- large geographical coverage (relatively) fast, at low cost, effort and risk

**Less suitable**

- none of the econometric methods to deal with selection bias is entirely satisfying = low internal validity
- for volatile/ noisy outcomes

**Research design issues**

- ideally should have reliable measure of adoption (genetic fingerprinting?) and a large sample
- think about control covariates/ instruments before collecting data
- given heterogeneity: what treatment effect are we measuring?

# Research design

## Observational panel studies

**More suitable**

- for volatile or dynamically evolving impacts (e.g. due to pests, learning, replacement)
- for long-run outcomes: income, poverty, assets/ savings, health

**Less suitable**

- once adoption is near its maximum, adoption rates are constant and only few people (dis-)adopt
- if difficult to predict where adoption will occur

**Research design issues**

- need to estimate in advance where adoption will occur and which outcomes and characteristics might be of interest
- reasons for attrition and relation to impacts (migration)
- repeated surveying could change reporting (Hawthorne, fatigue effects)

# Research design

## Experimental studies

**More suitable**

- randomization is feasible
- for more complex interventions and outcomes
- to examine impact of institutional and market failures (cross-cutting design) on adoption

**Less suitable**

- adoption has progressed
- to study long run effects and impacts on late adopters
- main impact due to spill-overs or GE effects is expected to be on non-treated households

**Research design issues**

- Randomization ideally should be conducted at village level
- Trade-off between internal validity (through high compliance) and external validity (intervention can be realistically scaled up)

# Conclusion

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# Conclusion

| | |
|---|---|
| Identifying poverty impacts of agricultural research | is difficult but feasible: not with a single study but with sufficient data and insights from different approaches |
| | is not primarily an issue of the statistical method: if applyed rigorously many approaches, both quantitative and qualitative, can yield useful insights |
| | must begin at early stages of the introduction of a new technology, and it may need to last for many years. |
| | close collaboration between social scientists and the developers of the new technology is crucial |
| | may be complex and costly but it may provide valuable insights to feed back into research |

# Thank you for your attention!

Questions welcome now or at:

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